STATE OF NEVADA
AGENCY FOR NUCLEAR PROJECTS/
NUCLEAR WASTE PROJECT OFFICE

C O M M E N T S

on

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

DRAFT 1988 MISSION PLAN AMENDMENT

(DOE/RW-0187, JUNE 1988)

DISCLAIMER

September 30, 1988

MONITORED RETRIEVABLE STORAGE PLANNING

The Draft Mission Plan Amendment (DMPA) has misinterpreted the NWPAA's Monitored Retrievable Storage (MRS) provisions. The NWPAA authorizes DOE to site, construct, and operate an MRS facility, but the Amendments Act does not require DOE to site, construct, and operate an MRS facility. Further, while the NWPAA makes construction and operation of an MRS contingent upon construction and operation of the repository, the Amendments Act does not make construction and operation of the repository contingent upon the MRS. Under the NWPA and the NWPAA, the authorized waste management system consists of a repository and an MRS facility, but the required waste management system consists of one repository (plus federal interim storage, if needed). Therefore, the DMPA statement that the NWPAA "has eliminated the uncertainty about the inclusion of an MRS facility as an integral element of the system" (page 9) is inaccurate and misleading. Furthermore, it ignores the mandate of the MRS Review Commission, established in the NWPAA, to report to Congress on the "need" for an MRS, by its presumption of the Commission's finding on the matter.

The future inclusion of an MRS facility in the waste management system is not certain. First, siting and construction is dependent upon future congressional appropriation of funds and, if necessary, congressional override of host State's disapproval of the site. Second, location of the MRS,

if constructed, could be determined by the recommendations of the MRS Review Commission, by a host State or Tribe volunteering a site under a negotiated agreement, and by NRC licensing requirements. Third, the functions of the MRS facility (such as rod consolidation) depend upon the recommendations of the MRS Review Commission, and DOE decisions regarding the repository (such as waste package design) which may in turn be dependent upon the results of repository site characterization studies. Fourth, the timing of MRS commencement of operations in relation to repository operations is uncertain. While the NWPAA ties the MRS schedule to that of the repository, the NWPAA does not establish a date certain for MRS operations, so MRS operations could conceivably begin well after repository operations.

The uncertainties about the MRS facility cause major uncertainties in planning for the repository. Inclusion of an MRS in the waste system has a major, if not determinant, bearing, upon five major aspects of the repository, including:

1. construction of repository surface facilities;
2. preclosure operations at the repository;
3. transportation of wastes to the repository;
4. post-emplacement waste package performance in the repository; and
5. decommissioning of repository surface facilities.

The DMPA partially acknowledges the significance of the MRS for repository planning, but fails to draw the logical conclusion that the MRS causes major uncertainties which must be addressed in the repository and waste package design effort, and in the repository EIS. As long as major uncertainties about the MRS remain, DOE must clearly plan for two distinctly different repositories--one in a system without an MRS, and one in a system with an MRS. The DMPA must explain how these uncertainties and the resulting differences will be addressed in the Section 175 report and in the EIS scoping process.

The DMPA should also explain the inconsistency between its assumption of an MRS existing in the waste management system, without an evaluation of without-MRS scenarios, and the adoption of the alternative, no-NRS reference case in the DOE's Initial Version-Dry Cask Storage Study (DOE/RW-0196, August 1988), which was prepared pursuant to Section 5064 of the Nuclear Waste Policy Amendments Act of 1987. This is a significant inconsistency in that both the Congress and the utilities are greatly concerned about uncertainties of interim spent nuclear fuel storage, prior to the availability of a repository, which is also the subject of great uncertainty. Both entities will soon be in the position of making major policy decisions regarding interim spent fuel storage, and such planning and evaluation inconsistencies do little more than confuse and obfuscate the

situation and impose a further layer of uncertainty for decision-makers.

WASTE VOLUME, WASTE TYPES, AND NUMBER OF REPOSITORIES

When the Nuclear Waste Policy Act was passed, the Department of Energy had projected that existing and projected spent fuel volumes would be 70,000 metric tons heavy metal (MTHM) by the time the first repository was available for emplacement of first spent fuel. Hence the statutory limitation upon NRC licensure of a first nuclear waste repository. See 42 U.S.C. 10134(d).

DOE's projection was based on knowledge of spent fuel actually then existing at reactors and a reactor growth model of unknown magnitude (unknown to the State of Nevada). That same projection indicated volumes of 100,000 to 140,000 MTHM of spent fuel and other high-level wastes by the year 2020. Hence the requirement for a second repository.

The DMPA discussion of types and quantities of waste to be accepted at the repository is grossly inaccurate and misleading. DOE has identified three major types of waste--commercial spent nuclear fuel, vitrified defense and commercial high-level waste (HLW), and other radioactive wastes requiring deep geologic disposal. For each of these three waste types, the DMPA assumes

the lowest projected quantities to be accepted at the repository, and fails to inform the reader that other DOE reports show that much higher quantities of these wastes may require geologic disposal. DOE's selection of waste quantity assumptions in the DMPA is apparently intended to support the notion that only one repository will be required. Closer examination of available DOE information on waste quantities, coupled with an examination of technical constraints on the amount of waste which may be emplaced at Yucca Mountain, strongly suggest that a second repository will be required.

Commercial Spent Nuclear Fuel. In the DMPA, DOE has adopted the Energy Information Administration (EIA) 1987 "no-new-orders" for nuclear power capacity as its primary basis for planning. As the DMPA notes, this iS a major change in DOE policy. DOE's 1985 Mission Plan used EIA's "middle case" nuclear power scenario (later renamed the "upper reference" case). DOE's 1987 Mission Plan Amendment used EIA's "upper reference" case. The scenario chosen by DOE for use in the 1988 DMPA "represents the minimum expected quantity of spent fuel." (page 14). The EIA 1987 "no-new-orders, end-of-reactor-life" forecast projects total U.S. reactor discharges to be about 77,800 metric tons of heavy metal (MTHM) in the year 2020, and about 87,000 MTHM in the year 2036, when the last presently-planned reactor shuts down. Thus the DMPA assumes that 87,000 MTHM of repository disposal capacity

will be required to accept spent fuel discharges from commercial reactors currently in operation or under construction.

The DMPA fails to inform the reader that EIA's 1987 "no-new-orders", end-of-reactor-life" forecast is based upon several key assumptions, and the projected spent fuel inventory is highly sensitive to changes in these assumptions. EIA assumed a 30 percent increase in average fuel burnup by the year 2000, and further assumed a 40-year operating life-time for reactors. The assumed increase in fuel burnup is however, by no means certain. EIA's own sensitivity analysis shows that continuation of present discharge burnup would result in spent fuel inventories of about 86,000 MTHM in the year 2020, and about 100,000 MTHM in the year 2036. (DOE, 1987b; DOE, 1987c)

Moreover, EIA's assumptions about probable reactor lifetimes may be too low. There is currently considerable nuclear industry interest in extending reactor operations to 50 years, and possibly longer. Extending reactor operating lifetimes could result in significantly higher spent fuel inventories even if EIA's assumptions about increased discharge burnup prove accurate. (Evans, 1987). Assuming a 50 year operating lifetime and EIA's other assumptions unchanged, a spent fuel inventory of about 105,000 MTHM would be expected by the year 2046.
Even if nuclear utilities increase discharge burnup as assumed by EIA and adopted by DOE as a basis for planning, the need for a

second repository may not be diminished. Extended burnup may reduce the physical quantity of spent fuel requiring disposal relative to the 70,000 MTHM capacity limitation established by the NWPA. It will not however affect the technical basis of determining repository capacity requirements, which are primarily a function of thermal loading. Increases in fuel burnup result in roughly proportionate increases in spent fuel thermal output. For pressurized water reactor spent fuel assemblies 100 years after discharge, a 30 percent increase in burnup results in a 30 to 35 percent increase in thermal power (about 400 Watts per MTHM). (Roddy, 1986; DOE, 1987a).

Vitrified High-Level Waste (HLW). The DMPA assumes that "about 17,500 canisters (approximately 8750 MTHM) of defense high-level waste will be available for geologic disposal by the year 2020" based on DOE's integrated data base for 1987. (page 14). A more recent DOE report reveals that the total amount of Defense HLW requiring geologic disposal by the year 2000 could be as great as 39,500 canisters (about 19,750 MTHM) and as great as 54,000 canisters (about 27,000 MTHM) by the year 2020. (DOE, 1987a). The significantly larger defense HLW quantities would result from vitrification of HLW at Idaho National Engineering Laboratory (INEL) without prior removal of inert material and from vitrification of Hanford single-shell tank wastes for deep geologic disposal. The DMPA should acknowledge the possibility that the amount of defense HLW requiring deep geologic disposal

could be significantly greater than 17,500 canisters and address the implications for determining the need for and schedule for a second repository. The DMPA should also acknowledge the uncertainties about defense HLW characteristics identified in the Oak Ridge National Laboratory Waste characteristics report (for example, DOE's withholding of information regarding HLW stored at INEL due to national security reasons) and address the implications for repository planning of those waste characteristics which are assumed, namely that the defense waste canisters will vary significantly in thermal output (450 to 1,160 Watts per canister) and radioactivity (143 to 416 Kilocuries per canister) depending upon the source (Hanford, INEL, or Savannah River Plant). (DOE, 1987a).

Other Radioactive Wastes. The DMPA's greatest omission regarding waste receipts at the repository is in the area of "any other radioactive wastes that require deep geologic disposal." (page 14). DOE fails to acknowledge the analysis of these wastes in the Oak Ridge National Laboratory report on waste characteristics, which states: "These (miscellaneous) wastes are neither spent fuel nor conventional high-level waste as presently defined) but may not be appropriate for shallow-land burial for various reasons. Although most of them would probably be suitable for intermediate-depth disposal, the absence of such facilities may destine these materials for a geologic repository.

The disposal requirements for these wastes has not yet been defined; hence, their status remains undefined. "(DOE, 1987a). The report proceeds to identify five categories of "miscellaneous wastes". Using the assumptions in the waste characteristics report (DOE/RW-0184, Vol. 1), the assumptions in the DMPA regarding MRS operations, and the EIA 1987 "no-new-orders" scenario for commercial nuclear operations, the Nevada NWPO staff has calculated the following maximum potential quantities of transuranic and greater-than-Class-C (GTCC) wastes which may require disposal in a repository by the year 2020: 1) OCRWM generated waste from rod consolidation at the MRS: 4,700 cubic meters; 2) transuranic waste from West Valley, commercial reactors, and other industrial and institutional facilities: 1,500 cubic meters; 3) reactor decommissioning: 1,600 cubic meters; 4) radioisotope capsules (including Hanford): 500 cubic meters; and 5) GTCC wastes from routine reactor operations (no-new-orders case, 1990-2020): 8,500 cubic meters. The total quantity of miscellaneous wastes possibly requiring deep geologic disposal by 2020 is estimated to be 16,800 cubic meters; the total is about 20,600 cubic meters if EIA's "upper reference" case for nuclear power is assumed.

The Oak Ridge characteristics report further states: "If these (miscellaneous wastes) are disposed of in HWL-type canisters, 2 ft in diameter by 10 or 12 ft long, one canister could hold up to 1 cubic meter" Using this assumption, it

appears that if miscellaneous wastes require deep geologic disposal, as now seems the case (absent other disposal facilities for "intermediate level" wastes), the repository could receive 16,800 to 20,600 canisters of waste which are neither acknowledged nor evaluated in the DMPA. The DMPA must address the implications of miscellaneous waste disposal on repository transportation, repository surface facilities, repository waste handling operations, and repository design disposal capacity and the need for a second repository.

Findings in the Draft and Final Environmental Assessment for Yucca Mountain indicate that there is little lateral flexibility in repository placement at Yucca Mountain. (See Discussion of the site's volume limitations, Environmental Assessment for Yucca Mountain, DOE/RW-0073, pages 6-206-6-214). DOE's Consultation Draft Site Characterization Plan states that 1,420 plus or minus 210 acres will be needed in order to emplace 70,000 MTHM. Only 1,850 plus or minus 140 acres are available at Yucca Mountain's "primary repository area", according to DOE's own estimate. And the likelihood that space is homogeneous and isotropic, which DOE assumes, is very small.

Moreover, when the total acreage necessary to emplace 70,000 MTHM is analyzed in terms of maximum areal power density (loading), it is obvious that Yucca Mountain may be too small to emplace even 70,000 MTHM. Stein, et al., (Thermal Analyses of

NNWSI Conceptual Waste Package Design, UCID-20091, April 19, 1984), report the expected wattage per canister as: pressurized water reactor waste: 3.3 kilowatts; commercial high-level waste: 2.21 kilowatts; boiling water reactor waste: 3.42 kilowatts; average maximum areal power density: 3.05 kilowatts. DOE projects that 47,500 waste canisters will be emplaced in the repository (Consultation Draft Site Characterization Plan, page 8.3.5.10-22). 47,500 canisters at 3.05 kilowatts per canister with a maximum loading of 57 kilowatts per acre indicates that 2,542 acres of area are needed. This is 37 percent more acreage than DOE maintains is required. In fact the total area needed for a repository and the isolating envelope is about 3,023 acres. This analysis is not included in DOE's Site Characterization Plan.

The above calculation assumes a DOE proposed maximum areal power density of 57 kilowatts per acre. However, as DOE recognizes in its Consultation Draft Site Characterization Plan, page 6-36, proper waste package spacing in the repository should prevent the areal power density of 57 kilowatts per acre from being exceeded, emplacement borehole wall temperature of 275 degrees Centigrade from being exceeded, and the rock-mass temperature of 200 degrees Centigrade, 1 meter distant from emplacement boreholes, from being exceeded. Also, from a practical standpoint, the peak waste temperature should not exceed the temperature limit of the waste form or it may be

degraded. A comparison of these criteria with modeling results of Stein, et al. (UCID-2009, 1984) suggests that much lower areal power densities of about 43.6 kilowatts per acre should be used for boiling water and pressurized water reactor spent fuel or temperatures will exceed stated limits. If these lower areal power density limits were used, the required repository acreage would increase to 3,323 acres, almost 80 percent more than the space DOE maintains would be necessary.

The discussion of the Yucca Mountain sites's volume limitations, contained in the Environmental Assessment for Yucca Mountain, DOE-RW-0073, pages 6-206 through 6-214, reveal that these additional space requirements may only be satisfied if the "extension areas" identified in that discussion could be used. DOE's DMPA and its Consultative Draft Site Characterization Plan indicate no intention by DOE to thoroughly investigate the adequacy of those extension areas to isolate high-level waste.

Also, DOE's analysis of the available space within Yucca Mountain assumes that all of the space within the primary repository area (Zone 1) is homogenous and isotropic and would possess characteristics favorable to waste disposal. Part of the DOE's rationale for the exploratory shaft facility in-situ test design is to discover the extent of fault-damaged rock that is not suitable for waste emplacement, since it is known that such conditions exist in the proposed repository block. Clearly the

DMPA should provide more specifics on the contingencies which must be addressed in the event that Yucca Mountain is found unsuitable in size for anticipated waste quantities.

In any event, the physically adequacy of Yucca Mountain to accommodate more than 70,000 MTHM should not be supplanted for the statutory limitation against more spent fuel being buried there. The clear implication of DOE's comments is that the statutory impediment is really no impediment and that DOE could convince Congress to change it if DOE desires. As the nonconservative planning and the real physical limitations of Yucca Mountain this question is ultimately a policy question which the Congress postponed when it passed the Nuclear Waste Policy Amendments Act in 1987. Nevertheless, Congress did leave the 70,000 metric ton limit in place and DOE's repository planning should be responsive to this statutory direction.

TECHNICAL ADEQUACY OF THE YUCCA MOUNTAIN SITE

The 1987 Nuclear Waste Policy Amendments Act and the DOE's DMPA put heavy reliance on the technical capability of the Yucca Mountain site to isolate high-level nuclear waste. The surface based testing at Yucca Mountain began in 1978. DOE claims that it has produced "an extensive database on the properties of the site." (page 29).

That statement is premised on the basis that surface based characterization has been in progress at Yucca Mountain since May 1986. However, very little surface based site characterization has taken place at Yucca Mountain over the past two years. Some activity may have occurred away from the site but only routine monitoring and maintenance have occurred at the site itself. The Consultation Draft Site Characterization Plan reports that no new data have been acquired since 1983. None of the study activities given in the Consultation Draft Site Characterization Plan are underway at the site. The USGS has been working on some prototype testing at the site but is not implementing the tests or studies described in the Consultative Draft Site Characterization Plan.

DOE claims that surface based testing programs "began in 1978". However the "extensive database" on the properties of Yucca Mountain developed from that research were obtained without the benefit of an adequate quality assurance program which would meet the Nuclear Regulatory Commission's standards. It will therefore not be available to demonstrate, in the NRC license proceeding, the capability of the site to isolate waste. It is also important to note that none of the surfaced based site study which began in 1978 was directed toward discovering critical information that could have provided answers to potentially fatal flaws of the site (E.G. percolation rates, importance of fracture verses matrix flow, vadose water composition).

The unsaturated zone, within which the repository block is to be placed and below which is the ground water system, is not an easy zone to characterize. The unsaturated zone is essentially "opaque" to any of the proven geophysical techniques with adequate resolution. Characterization by use of geostatistical techniques will be necessary, but will not be sufficient to fully analyze the unsaturated zone and identify the specific conditions producing the most rapid paths of waste migration to the accessible environment. To obtaining sufficient data for calibrating the statistical model by itself would require so many boreholes that the integrity of the site to contain waste comes into question.

DOE states, at page 26 of the Draft Mission Plan Amendment, that:

> "The program for characterizing Yucca Mountain puts considerable emphasis on the characteristics of ground-water flow in the rocks in which the waste would be emplaced. Ground water is important because it is the principal mechanism by which radioactive material in the waste can be transported to the accessible environmental. . . . . Current estimates indicate that probably less than 0.02 inch of the approximately 6 inches of rainfall that falls annually percolates through the rock matrix to the unsaturated zone."

This discussion of Yucca Mountain's virtues is somewhat misleading. The estimated percolation rate is an estimation for the vertical component only and does not consider fracture flow along the active faults at Yucca Mountain at all. Also, this "favorable" rate is the one DOE expects to find in the ground above the repository. But the system beneath the repository is the crucial one. DOE may not even investigate that system, according to the Consultation Draft Site Characterization Plan.

DOE claims that it has attempted "whenever possible, to release technical information as soon as practicable" to the states and Indian tribes. Page 61. DOE also claims that under its agreement with the NRC, "the agreement also provides for the exchange of information developed by either party." Page 44. This statement is seriously misleading. DOE's early release of various program documents, including the Environmental Assessment, did not provide adequate technical information, especially when a number of key references to material contained therein were not available, and some had not even been written. In regard to the Consultation Draft Site Characterization Plan, the accompanying plans and reports needed for comprehensive, constructive comment were not presented and are still unavailable, notwithstanding the earlier DOE commitment that they would be available for our review. Only two of the draft study plans describing the basis for and description of the proposed site characterization activity have been provided to

proposed site characterization activity have been provided to date, and both Nevada and the NRC staff have indicated to DOE that they lack sufficient detail for substantive review. Furthermore, the unfulfilled commitment included DOE plans for environmental assessment of its planned site characterization activities, so that Nevada could assist in minimizing those impacts, as the NWPA requires. In sum, being forced to a premature, piecemeal review of DOE planning and decision documents hinders, rather than enhances, the State's ability to meet its oversight obligations pursuant to the NWPA.

The process by which much of the actual technical information is disseminated by DOE is cumbersome. For example much of the work by the U.S. Geological Survey and other DOE contractors takes three years to be formally distributed once it is written. Raw data, reports and analysis of that data should be made available to the State in a much more timely manner. The few raw data reports requested by Nevada, and known to exist at the time, have taken up to six months to be delivered by DOE. Furthermore, a recent request for raw data from DOE seismic sensing equipment has been refused on the basis that the data are classified as a result of national security constraints associated with weapons testing at the Nevada Test Site. These same data are being used by DOE in seismic design work for repository facilities engineering, which will be subject to license review, as it is important to safety.

The State of Nevada has been largely unsuccessful in its efforts to have its technical comments incorporated into DOE's technical program. For example, the State has repeatedly argued that DOE should consider a range of groundwater flux values greater than .5 millimeters per year. This value has been used by DOE for years as the upper bound value despite it being virtually without technical basis. On several occasions, the State has provided ample technical rationale that suggests that a higher value may well be more appropriate. But Nevada's suggestions have gone unheeded. Other areas where the extensive critical review provided by the State has been altogether unacknowledged by DOE include: a) the significance in occurrence of perched water; b) the lack of proven technology for predicting thermally-induced liquid and vapor transport in vertical fractures; c) the highly developmental nature of gas circulation studies; d) the highly developmental nature of fracture network studies (fractals); and e) causes of observed water-level fluctuations that appear to include fault creep and distant earth quakes.

Nevada's technical contractors have discovered some instances in which interpretations of data have been placed in programmatic documents, such as the Environmental Assessment and Consultative Draft Site Characterization Plan, which interpretations are not those of the individuals who either

collected or analyzed the original data. Some information has been removed from its original context, eliminating any caveats placed upon its use, and has been presented as fact or in a more favorable light.

DOE's approach to technical participation is insufficient, in that it focuses on review of DOE's technical documents, information, and data. This approach is too limited. Nevada, and other affected parties, must be permitted to conduct reasonable and necessary independent technical and scientific evaluations, including field studies, sample acquisition, and analytical work, to confirm DOE's site characterization findings, as provided by the NWPA. Further, the ability to pursue this legitimate oversight activity must not be obstructed by bureaucratic delay and other such tampering.

ALTERNATIVES TO THE YUCCA MOUNTAIN SITE

A significant defect in DOE's approach to site characterization is that there is no decision-making strategy or mechanism in place with which to evaluate whether the Yucca Mountain site is unsuitable until the completion of characterization. The Draft Mission Plan Amendment states:

> "If the Yucca Mountain site is determined to be unsuitable for a repository, then the DOE is the terminate all site-characterization activities at the

site, notify the Congress as well as the Governor in the Legislature of Nevada of the termination and the reasons for the termination, and not later that six months after such determination recommend to the Congress further action to provide for the permanent disposal of the waste." (page 24).

DOE should acknowledge the need for, and establish a process which would identify the site's deficiencies early, if they exist, so that alternatives could be explored, thus avoiding nuclear utilities and ratepayers having supported an expensive site characterization program for many years, only to have it fail or be non-conclusive at the end of the planned period of work.

SCHEDULE

The schedule for repository development published in the DMPA is yet a further compression, from past schedules, of the time period for technical information gathering during the site characterization period. It anticipates no surprises in the geologic system, something that never happens when significant geologic investigations are undertaken. An additional six months have now been eliminated from the beginning period of exploratory shaft excavation and DOE is already six months behind that

schedule. However the end points in the overall schedule have not been adjusted accordingly. Five years between the start of in-situ work and submission of the license application to NRC is an insufficient amount of time to develop enough scientific evidence to enter a licensing proceeding with the requisite quality application. Nevada's technical contractors estimate that seven to ten years may be the minimum time necessary to characterize and develop any confident understanding of the critical hydrogeologic attributes of the site.

DOE's schedule for repository development, contemplating waste acceptance at the repository by the year 2003, appears to be developed without any heed of historic experience with delays and slipped schedules. DOE, and Congress, have chosen to site the repository in a very complex hydrogeologic setting for which unprecedented, sophisticated, long-term modeling predictions must be made. A substantial amount of basic scientific research efforts and model development and validation must be accomplished just to get the site characterization data collection program under way. This is particularly true for the in-situ testing program for which applicable models and methods are still in the "to be determined" phase, as indicated in the Consultative Draft Site Characterization Plan.

DOE apparently intends to reduce the scope of site investigation during construction of the exploratory shaft.

Though the Consultation Draft Site Characterization Plan describes the total depth of the exploratory shaft as 1,500 feet, the Draft Mission Plan Amendment indicates a reduction of its depth to 1,050 feet. The Draft Mission Plan Amendment describes the repository construction horizon to be at a depth of about 1,000 feet. So DOE's site analysis apparently will only extend as deep as the repository itself notwithstanding the extensive waste isolation and retardation credit which the Department has always attributed to the underlying horizon, and which was a substantial basis for earlier recommending Yucca Mountain as a repository candidate site.

Overall, the schedule proposed for commencement of operations at a Yucca Mountain repository is highly optimistic and unwarranted given the significant earth science issues which exist regarding Yucca Mountain. Not only has DOE shortened the site characterization period, but DOE has also failed to include any contingency time into its schedule. It presumes that no events or problems may occur about which DOE is not now aware. (The schedule even presumes that some problems about which DOE is currently aware, will not exist.) DOE further has no contingency plan in anticipation of the likely situation that the NRC's licensing review cannot be completed within the statutory 36 or 48 month required. NRC is currently making legitimate planning efforts to get its license review work done within the statutory period. Nevertheless, the Commission's substantive

responsibilities under the Atomic Energy Act are clearly paramount to its responsibility to act within a particular time frame and the Commission should take as much time as necessary to insure that the repository proposal is worthy of a construction authorization and license. DOE's program schedule should take this into account, especially where DOE now proposes to shorten the site characterization period, thus increasing the risk that its license application will require further data and analysis for NRC review after initial submission.

A significant oversight in the DOE's schedule is the lack of any allowance for NRC review and approval of a permit for the repository to receive waste when the facility is prepared to begin operations. This matter will be discussed further in the section on repository licensing.

TRANSPORTATION

The DMPA discussion of transportation, although more specific than the discussion in the 1987 Mission Plan Amendment, is none-the-less unacceptably vague and inadequate for planning purposes. The DMPA lacks a transportation program critical path schedule; and, the transportation element of the preliminary integrated schedule (page 17) is inadequate. In general, the DMPA fails to recognize congressional intent, as expressed in Section 180(c) of the NWPAA, that States should play a greater

routine operations and emergency response to accident situations. The transportation discussion is particularly deficient in three areas: transportation modal mix (rail, barge, and overweight truck options); relationship between early designation of routes and application of systems engineering approach to transportation; and site-specific aspects of transportation to Yucca Mountain which require study during site characterization.

Selection of Modes and Routes. The DMPA provides no meaningful information regarding the procedures DOE plans to use in selecting modes and routes for waste shipments to the repository. Nor does the DMPA reveal DOE's anticipated schedule for these decisions, although "DOE plans to compile a list of potential routes in time to support training requirements." (page 65). Thus DOE's "list of potential routes" might not be presented to the affected States, Tribes, and local governments until as late as 1998-2000.

The DMPA endorses the application of systems engineering to permit DOE "to consider and apply the appropriate available technology and commercial expertise to achieve the best overall solution for the long-term disposal of radioactive wastes." (page 48). Early designation of waste shipment modes and routes is essential for applying systems engineering to development of the waste management and transportation system. During the scoping process for the Draft EIS (1989-1993), DOE should

scoping process for the Draft EIS (1989-1993), DOE should identify the preferred routes for shipments by each mode under consideration (highway, rail, barge) from all expected or contemplated sources to the repository, in a system without an MRS. DOE should also identify as soon as possible the preferred routes for shipments by each mode to the repository from each of the MRS candidate sites (now, scheduled to be identified in 1992). Information about the preferred modes and routes could then be used in developing the following key components of the waste transportation system:

1. Shipping Cask Designs. Early designation of modes and routes would allow the shipping cask design process to address actual route characteristics and potential hazards. Data for highly populated areas, unyielding surfaces, crush hazards, drop hazards, fire hazards, and water hazards along identified routes could be used in evaluating cask performance during routine operations and in severe accidents. DOE currently plans to submit cask safety analysis reports to the NRC as early as 1991.

2. Operations Plans. Early designation of modes and routes would allow the development of a transportation system operations plan based on actual route conditions, traffic patterns, and private sector capabilities. Route specific data are essential for

evaluating the present condition of transportation infrastructure, the need for and cost of infrastructure improvements, and the impact of infrastructure conditions on day-to-day transportation operations. Route specific data are also needed regarding traffic patterns (such as time of day, daily, and seasonal variations); nature and frequency of other hazardous materials shipments along the same routes; availability of rest areas and safe havens; impact of weather conditions on shipments (including control and maintenance), escorts, and inspections; and national and regional capabilities of private sector water carriers, motor carriers and railroads. DOE currently plans to issue a draft Comprehensive Transportation Plan in early 1989, but the schedule for operations planning is uncertain. Also, the relationship of the Comprehensive Transportation Plan to the EIS scoping and development process should be defined in the DMPA.

3. Emergency Response Plans. Early designation of modes and routes would allow the development of emergency response plans and training programs, as required under Section 180(c) of the NWPAA, based on actual and anticipated conditions. Route surveys would identify locations of past accidents, and their frequency and consequences, as well as physical conditions or other

route characteristics which would increase the probability and/or consequence of a nuclear waste transportation accident or hinder emergency response activities after an accident, including control, containment and cleanup. Route specific data is essential for determining special personnel and equipment requirements. DOE is already developing general emergency response plans in cooperation with DOT and the Federal Emergency Management Agency, but has not issued a definite schedule for implementation of Section 180(c).

4. Public Participation. Early designation of modes and routes would facilitate participation in DOE's transportation planning process by affected States, Tribes, local governments and individuals who live along potential routes. Early and broad public participation would assist transportation systems engineering in issue scoping and by providing otherwise unavailable human factors information, such as likely official and public responses to routine operations and accidents. Early and broad public participation may also contribute to public confidence in and acceptance of DOE's transportation planning process, if meaningful opportunities for participation and conflict resolution are provided by DOE.

The DMPA states that "no surface mode of transportation has been ruled out, and, in the case of reactors located on waterways, it is possible that spent fuel may be shipped part of the way by barge and transferred to a railcar for the remainder of the trip to the MRS facility or to the repository." (Page 16). The DMPA further states: "Barge transportation is an option that remains open, but it will be exercised only in those circumstances where it provides safety or logistics advantages (i.e., at reactors with particularly favorable locations for barge transport." (page 42). A DOE-sponsored study by Argonne National Laboratory (Tobin and Meshkov, 1985) concluded that barge/rail transport was feasible for 35 reactor sites in 20 states and identified shipping scenarios under which barge/rail shipment might reduce transportation risk. In spite of these favorable preliminary findings, DOE has not announced any specific plans for further evaluation of the barge option, although DOE has selected contractors for the development of three rail-and-barge cask designs. What are DOE's plans and schedule for further evaluation of barge transport of spent fuel and HLW?

The DMPA assumes that most spent fuel and HLW will be transported to the repository by rail. There are two major problems with this assumption. First, the Yucca Mountain site is not presently accessible by rail. A minimum of 100 miles of new

spur construction will be necessary to connect Yucca Mountain with the nearest mainline railroad, and more than 200 miles of new construction could be required depending upon the access route selected. DOE has not demonstrated the feasibility of rail transportation to Yucca Mountain nor the likelihood that rail access will be achieved by 2003, the year in which nuclear waste deliveries are scheduled to begin. Second, the NWPA requires DOE to rely upon the private sector transportation services "to the fullest extent possible." DOE, however, has for the past decade refused to accept the safety procedures for spent fuel transportation adopted by the Association of American railroads (AAR). DOE believes that spent fuel and HLW can be shipped in existing casks as general rail freight, although DOE proposes to use dedicated (unit) trains for shipments from the MRS to the repository. The AAR Board of Directors has adopted the position that spent fuel should only be transported by special train service (also referred to as dedicated nuclear train service) subject to three operating conditions: train speed must be restricted to maximum of 35 miles per hour; when the dedicated train meets another train, one train must stop before passing; and no other commodities can be carried on the dedicated train.

The DMPA states that the "design and development of overweight truck casks ... has been deferred." The purported deferral is apparently only temporary. A cover letter and survey dated August 24, 1988, distributed to members of the

International Bridge, Tunnel and Turnpike Association (IBTTA), states: "The IBTTA is working with the American Association of State Highway and Transportation Officials (AASHTO) and the Department of Energy (DOE) to explore uniform permitting for possible highway shipment of spent fuel in overweight trucks." IBTTA members are requested to complete questionnaires regarding the feasibility of overweight truck shipments by October 7, 1988. IBTTA plans to develop recommendations" to assist DOE in the decision whether or not to retain the overweight truck option." When does DOE plan to make a final decision on use of overweight trucks?

The IBTTA survey makes a number of assumptions about how overweight truck shipments would be regulated under a nationwide uniform permitting system, including:

> "Permits will allow for travel at any time, including hours of darkness and weekends. Shipments on national holidays will be prohibited. Further, escort vehicles will not be required nor will speeds be restricted."

> "Permit movement will be for a pre-approved vehicle and load operating over the same pre-designated routes in individual states. Each state will review and approve routing before defining the combination of highways to be used within the state for all future movements of spent fuel to the repository site."

"The route system will be the Interstate system with any alternative routes selected by individual states in accordance with federal regulations. The type of permit used will be consistent with those presently allowable in individual states where possible (e.g., multi-trip, annual, telephone, prepaid). The transporter will be required to check short-term restrictions via telephone with each affected state five (5) days prior to movement over pre-designated routes."

"Individual states and toll authorities will collect their regular permit fees."

Do the assumptions stated in the IBTTA survey represent DOE's position on overweight truck operations under uniform national permitting? Will operating assumptions such as absence of escorts and unrestricted speed (within legal limits) be explicitly considered in the development of overweight truck cask designs?

Transportation Issues Requiring Study During Site Characterization at Yucca Mountain. The DMPA fails to acknowledge the transportation difficulties associated with siting a repository at Yucca Mountain, and is silent regarding the studies DOE must conduct during site characterization before

concluding [in order to demonstrate?] that nuclear waste transportation to Yucca Mountain is feasible, safe, environmentally acceptable, and economically reasonable.

Based on DOE's analysis of transportation impacts in the first repository environmental assessments (EAs), Yucca Mountain is one of the least desirable locations among those considered for a national nuclear waste repository. Compared to other sites considered by DOE, Yucca Mountain has the worst accessibility to the national transportation network; has the most difficult construction requirements for access to the national rail network; and will result in greater nationwide system transportation impacts and risks.

The DMPA provides no information on the transportation studies which must be conducted during site characterization. Yet the DMPA states that the environmental impact statement (EIS) for Yucca Mountain will address "the effects, both radiological and nonradiological, that are expected from waste transportation." (page 31]). The DMPA similarly states that transportation will be considered in various environmental studies (page 27), and in the Section 175 report on socioeconomic impacts and mitigation (page 60), but no details are provided. The discussion of repository design and engineering merely asserts: "Both rail and highway access to the site will be provided." (page 36).

DOE's current schedule calls for issuance of a draft EIS in 1993 and a final EIS in 1994. In order to meet this schedule, DOE must soon develop plans for resolving outstanding questions about transportation of waste to Yucca Mountain. Major issues identified to date are:

1. Feasibility of rail transportation to Yucca Mountain. The site presently lacks rail access. A minimum of 100 miles of new rail spur must be constructed to connect with the nearest mainline railroad, and more than 200 miles of new construction and upgrading may be required depending upon the access route selected. DOE failed a preliminary environmental screening. Each of the three routes still under consideration involve major problems such as difficult terrain, Indian reservation lands and ceded lands subject to treaty claims, environmentally sensitive areas including areas designated for wilderness study, and land use conflicts with U.S. Air Force and private industrial operations. Land acquisition and environmental approval may be extremely difficult and time-consuming if not impossible. Even if rail transportation proves feasible, the cost may greater exceed the cost of truck or rail/truck transportation.

2. Impacts of waste transportation through the Las Vegas metropolitan area. Virtually every shipment of nuclear waste to Yucca Mountain, whether by rail or highway, likely will travel through high populated areas in the Las Vegas metropolitan area. DOE must demonstrate that these shipments can be conducted without unacceptable risks to public health and safety, and that the perceived risk of transportation will not result in unacceptable socioeconomic impacts. DOE must evaluate the comparative costs and risks of relocating rail and highway routes to bypass highly populated areas and avoid route segments with highly congested traffic patterns.

3. Impacts of waste transportation on Nevada Indian Tribes. The vast majority of waste shipments to Yucca Mountain are expected to occur on the Union Pacific railroad and on Interstate 15 through the Moapa River Indian Reservation. Construction of new rail and highway access to Yucca Mountain may affect the Moapa River Indian Reservation, the Walker River Indian Reservation, and ceded treaty lands claimed by the Western Shoshone Nation. DOE must evaluate the impacts of shipments through the construction of Indian lands, and the implications of potential tribal regulation of shipments to Yucca Mountain.

4. Special hazards associated with waste transportation to Yucca Mountain. Proximity of the Yucca Mountain site to major U.S. Air Force and Navy air bases and the Las Vegas International Airport pose special hazards to waste transportation. Virtually every shipment of nuclear waste to Yucca Mountain, whether by rail or highway, will travel through the flight paths of civilian and military aircraft. DOE must evaluate the special hazards of aircraft overflights, including the potential consequences of a catastrophic accident, and must incorporate the results of this hazard analysis in the design of the shipping casks and development of the operational plans to be used for transporting nuclear waste to Yucca Mountain.

LICENSING OF HIGH-LEVEL NUCLEAR WASTE REPOSITORY

The authority to license a high-level nuclear waste repository is placed within the Nuclear Regulatory Commission by the "nuclear materials" provisions of the Atomic Energy Act of 1954 as amended, 42 U.S.C. 2071-2114. The NRC has construed that authority into a process requiring a "construction authorization", 10 C.F.R. 60.31, and a "license to receive and possess source, special nuclear, or byproduct material," 10 C.F.R. 60.41. The NWPA refers only to a "construction

authorization", see 42 U.S.C. 10134(d), but the NRC anticipates, and Nevada agrees, that both will be required.

Sequencing of Construction Authorization and Materials License. DOE's Draft Mission Plan Amendment declares that "When the repository is ready for operation, the Secretary will submit an application to the NRC to receive and possess radioactive waste at the site." (page 4), i.e., DOE plans to begin waste emplacement prior to completion of construction.
This approach is amplified at pp. 37-38. "This approach will allow underground development and waste emplacement operations to proceed essentially in parallel . . . . Thus, the development of the underground repository will continue for many years."

DOE obviously recognizes the problem of repository investigation and construction excavation creating potential pathways for waste migration and loss of waste isolation, but minimizes it, acknowledging that the design objective of postclosure seals is to "reduce, to the extent practicable, the potential for creating preferential pathways for ground water or radionuclide migration through existing pathways.", (page 38). But that is not enough. NRC's regulations require that DOE demonstrate, with reasonable assurance, that the repository will perform in such a manner as to comply with EPA's environmental standards for waste isolation. Demonstration of that performance must take the actual ground water or radionuclide migration

factor, reduced by postclosure seals, into account. And that cannot be done until DOE knows precisely what it has to seal. This can only be done from an as-built perspective. Theoretical design plans of the repository yet to be constructed would be inadequate to inform the NRC of the predictability of its performance of waste isolation. In a similar fashion, NRC requires that a nuclear generating facility be sufficiently constructed to permit evaluation of whether it is safe to commence operation, even on a phased schedule.

At any point of repository construction the excavation work could reveal a major underground fault or other irreparable condition compromising waste isolation, particularly at Yucca Mountain. The proof that DOE and NRC acknowledge this fact, in general, is that both agencies are concerned that even 6" diameter exploratory boreholes may create preferential pathways for ground water and radionuclide migration which exceed acceptable standards. And a materials license should be considered only with knowledge of all additional information which becomes available by completion of the repository excavation and construction process. With this licensing reality in mind, DOE's schedule should be extended to accommodate the time necessary to obtain a materials license.

Quality Assurance. DOE is required by 10 C.F.R. 60.152 to implement a quality assurance program based on criteria of Appendix B of 10 C.F.R. 50. That quality assurance program must apply "to all systems, structures and components important to safety, to design and characterization of barriers important to waste isolation and to activities related thereto." Scientific data which have been collected and analyzed without an adequate and acceptable quality assurance program in place may not be entertained by the NRC in considering whether to grant a construction authorization for a repository.

The DOE's quality assurance program, at present, is incomplete, with only a portion having been submitted for NRC review. The entire program lacks favorable audit of its effective implementation. None of the data collected by the USGS at the Yucca Mountain site has been collected pursuant to an acceptable QA program. The implications of these facts are that 1) Congress's reliance on DOE's recommendation of Yucca Mountain (which was based largely upon confidence in that research) may have been premature, and 2) DOE will not be able to rely on any of that information in an NRC licensing proceeding. This is a significant problem, the size and cost of which is totally unaddressed in DOE's Draft Mission Plan Amendment.

DOE has responded to its quality assurance problem with an institutional, bureaucratic response: a new Office of Quality

Assurance headed by an "associate director" has been established. Meanwhile a significant portion of the USGS field and data analysis programs are subject to current stop work orders, not acknowledged in the Draft Mission Plan Amendment, until approved quality assurance programs are in place and their effective implementation is demonstrated. Furthermore, DOE has made no report on the status of its broader QA problems in its Draft Mission Plan Amendment, nor has it factored the necessary time for their demonstrated resolution into its schedule, even in light of the fact that the NRC has strongly recommended that site characterization work not commence until resolution has been demonstrated to be effectively implemented.

Alternative Conceptual Models. Recently the NRC staff has reviewed and commented upon the DOE's Consultation Draft Site Characterization Plan. Part of NRC's comments include a fundamental concern about DOE's failure to establish alternative conceptual models (working hypotheses) for describing the geohydrology of the Yucca Mountain site, and guiding its characterization planning. The Draft Mission Plan Amendment fails even to address the significance of this criticism as it pertains to DOE's Requirement to prove its case in a licensing proceeding. The April 1988 conceptual models meeting of NRC, DOE and Nevada technical personnel should be discussed in the Draft Mission Plan Amendment and NRC's, and Nevada's significant comments should be

given sufficient recognition so as to more accurately represent the current condition of DOE's program.

SOCIOECONOMIC PLANNING

The Draft Mission Plan Amendment (Section 3.1.1.4, page 28) makes reference to the draft Socioeconomic Monitoring and Mitigation Plan which is DOE's general plan for monitoring potential significant socioeconomic impacts of site characterization. It should be noted that Nevada submitted its comments on that draft plan on March 16, 1988. The DMPA should also report that the primary thrust of the State's comments is that the draft SMMP assumes, based upon the DOE's May, 1986, Environmental Assessment of the Yucca Mountain Site, that there will be no significant impacts of site characterization. This position of the DOE is purely an assumption, in that no studies have been carried out by DOE to substantiate such a conclusion in either document.

Section 175 of the Nuclear Waste Policy Amendments Act of 1987 requires that the DOE report to the Congress, by December 22, 1988, on the potential socioeconomic impacts of site characterization, among other topics. The DOE requested and received for its use in preparing the report, the Nevada Nuclear Waste Project Office's complete and substantial file of economic, demographic, and fiscal data collected to date, pursuant to the

State's NWPA oversight program. After its commitment, accompanying the data request, that a draft of its Section 175 report would be offered for Nevada's review, we were dismayed to learn, after delivery of the data, that such an offer will likely not be forthcoming. We will review and comment on the final Section 175 report when it becomes available, and will be interested especially to learn whether DOE has found that it can substantiate its earlier assumption of being no potential significant socioeconomic impacts of site characterization.

The DMPA is inaccurate in its description of the requirements of Section 175 of the NWPAA in that it fails to state that DOE is to report on the socioeconomic impacts of "locating" a repository at Yucca Mountain. We believe, contrary to DOE's opinion, that this requirement includes the directive to analyze impacts beyond the borders of the State of Nevada, especially as they relate to nuclear waste transportation. The Section 175 report will be incomplete and inaccurate if it fails to include evaluation of impacts outside the State of Nevada.

ENVIRONMENTAL PLANNING

The Draft Mission Plan Amendment discussion of environmental planning (Section 3.1.1.3, page 27) recommits the repository program to DOE's policy to "conduct its operations in an environmentally safe and sound manner." In preface to our

comments on environmental planning, it must be noted that, to date, essentially all of the field work conducted relative to the Yucca Mountain site over the past approximately 10 years has been carried out without the DOE seeking or obtaining State permits for air quality, borehole drilling, water rights acquisition, and use of radioactive materials in borehole logging, and without reclamation of the federal public lands that were disturbed by borehole drilling, geophysical testing, trenching, etc.

In recent months, the DOE has begun making application to Nevada for environmental permits for its future work related to the site, however, it is the current view of the State that a Site Characterization Plan, as required by Section 113 of the NWPA, including descriptions of the details of the specific activities planned, should be issued by DOE prior to DOE seeking the appropriate permits and other approvals from Nevada agencies. The planned needs and activities described in the applications submitted to date have been inconsistent with the descriptions of planned site characterization work contained in the DOE's 1986 Environmental Assessments for the Yucca Mountain site, and are not known to be consistent with the activities described in the Site Characterization Plan which has yet to be issued for review and comment. Therefore, there is no authoritative and reviewed program document from which the plans described in the applications have been derived, and there is no certainty that these plans will be representative of the field work, once it is

undertaken. In addition, piecemealing the project work to avoid regulatory requirements is viewed as unacceptable, and should not be contemplated by the DOE, as it is not in accord even with its own environmental protection policy.

Nevada has commented on the DOE's Environmental Regulatory Compliance Plan, on March 11, 1988, finding it to be a reasonably complete inventory of the federal and state laws and regulations that may be applicable to DOE's Yucca Mountain work.

Of great concern to Nevada is the DOE's assumption that no significant environmental impacts will result from Site Characterization. This assumption is found in the 1986 Environmental Assessment for the Yucca Mountain site, and later repeated in the draft Environmental Monitoring and Mitigation Plan, upon which Nevada commented to DOE on March 11, 1988. This assumption has no basis in fact, since there is no comprehensive environmental baseline information describing the undisturbed natural condition of the Yucca Mountain setting. Nevada also takes great issue with the DOE's determination that it will not establish such a baseline for environmental impact analysis of a repository until after the completion of Site Characterization and its accompanying disturbances. This situation has resulted in Nevada, as part of its oversight program, initiating environmental surveys and studies of the site to establish a detailed knowledge of the current, and as much as possible,

previous undisturbed conditions of the site. Nevada is currently seeking approvals from DOE for access to the Nevada Test Site portion of the Yucca Mountain site to carry out its field environmental surveys.

Nevada does not believe the DOE's position regarding establishment of environmental baseline conditions following the Site Characterization disturbances to be consistent with the requirements of the National Environmental Policy Act (NEPA), nor is it consistent with the DOE's own policy for environmental protection.

The DMPA states that the draft Environmental Program Plan (EPP) for the entire site selection and repository program will be issued for Nevada's review. It is essential that the EPP, at least for site characterization activities, and all Environmental Field Activity Plans (EFAP's) be issued prior to, or along with the Site Characterization Plan. This is necessary so that Nevada may fulfill its duty to assist, as required by the NWPA, in seeking to minimize the impacts of site characterization. It is only through review of the comprehensive plans of DOE's field activities and potential disturbances, along with its plans for environmental information gathering that Nevada can become sufficiently informed to suggest and seek constructive means of accomplishing minimization of environmental impacts resulting from the DOE's Yucca Mountain site program.

Selected References for Waste Volume, Waste Types, and Number of Repositories

Evans, T.J., and R.J. Halstead, 1987. "How Many Geologic Repositories Will Be Needed?", Waste Management 87, Proceedings of the Symposium on Waste Management, Tucson, AZ, Vol. 2, 33-40.

Furber, C.P., 1988. "Transportation of Spent Fuel by Rail," Presentation to 1988 Annual Meeting, National Conference of State Legislators, Reno, NV.

International Bridge, Tunnel and Turnpike Association, August 24, 1988. Letter to Principal Contacts: United States Active Members, Subject: Survey of Overweight Permit Requirements for Transportation of Spent Nuclear Fuel, Washington, DC.

Roddy, J.W., et al., 1986. Physical and Decay Characteristics of Commercial LWR Spent Fuel, Prepared by Oak Ridge National Laboratory for U.S. Department of Energy, ORNL/TM/9591/V1&R1, Oak Ridge, TN.

Tobin, R.L., N.K. Meshkov, and R.H. Jones, 1985. Preliminary Assessment of Costs and Risks of Transporting Spent Fuel by Barge, ANL/ER-TM-85-2, Prepared by Argonne National Laboratory for U.S. Department of Energy, Argonee, IL.

U.S. Department of Energy, 1986. Report of the Task Force on the MRS/Repository Interface, DOE/RW-0044, Office of Civilian Radioactive Waste Management, Washington, DC.

U.S. Department of Energy, 1987a. Characteristics of Spent Fuel, High-Level Waste, and Other Radioactive Wastes Which May Require Long-term Isolation, DOE/RW-0184, Vols. 1-6, Office of Civilian Radioactive Waste Management, Washington, DC.

US. Department of Energy, 1987b. Commercial Nuclear Power, 1987: Prospects for the United States and the World, DOE/ETA-0438(87), Energy Information Administration, Washington, DC.

U.S. Department of Energy, 1987c. World Nuclear Fuel Cycle Requirements: 1987, DOE/EIA-0436(87), Energy Information Administration, Washington, DC.